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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
10/642,856	08/18/2003	Martin Freitag	MUH-12720	3363

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EXAMINER

GRAHAM, KRETILIA

ART UNIT	PAPER NUMBER
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2827

SHORTENED STATUTORY PERIOD OF RESPONSE	MAIL DATE	DELIVERY MODE
3 MONTHS	03/22/2007	PAPER

Please find below and/or attached an Office communication concerning this application or proceeding.

If NO period for reply is specified above, the maximum statutory period will apply and will expire 6 MONTHS from the mailing date of this communication.

Office Action Summary

Application No.

10/642,856

Applicant(s)

FREITAG ET AL.

Examiner

Kretelia Graham

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-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 February 2007.
- 2a) ☐ This action is **FINAL**. 2b) ☒ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1, 2 and 4-7 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1 and 4 is/are rejected.
- 7) ☒ Claim(s) 2 and 5-7 is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 18 August 2003 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☒ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☒ All b) ☐ Some * c) ☐ None of:
- ☒ Certified copies of the priority documents have been received.
 - ☐ Certified copies of the priority documents have been received in Application No. _____.
 - ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

* See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- | | |
|--|---|
| 1) <input type="checkbox"/> Notice of References Cited (PTO-892) | 4) <input type="checkbox"/> Interview Summary (PTO-413) |
| 2) <input type="checkbox"/> Notice of Draftsperson's Patent Drawing Review (PTO-948) | Paper No(s)/Mail Date. _____ |
| 3) <input type="checkbox"/> Information Disclosure Statement(s) (PTO/SB/08) | 5) <input type="checkbox"/> Notice of Informal Patent Application |
| Paper No(s)/Mail Date _____ | 6) <input type="checkbox"/> Other: _____ |

DETAILED ACTION

Continued Examination Under 37 CFR 1.114

1. A request for continued examination under 37 CFR 1.114, including the fee set forth in 37 CFR 1.17(e), was filed in this application after final rejection. Since this application is eligible for continued examination under 37 CFR 1.114, and the fee set forth in 37 CFR 1.17(e) has been timely paid, the finality of the previous Office action has been withdrawn pursuant to 37 CFR 1.114. Applicant's submission filed on 2/26/2007 has been entered.

Response to Arguments

2. Applicant's arguments, filed 2/26/2007, with respect to the objection to the claims have been fully considered and are persuasive. The objection of the claims has been withdrawn.

3. Applicant's arguments filed 2/26/2007 have been fully considered but they are not persuasive.

In response to applicant's argument that the US patent to Nakao (6,509,621 B2), hereafter "Nakao" fails to teach rotating the magnetization direction of the soft magnetic layer in a plurality of successive steps, the Examiner directs applicant's attention to **FIG. 9B – 9C and column 10, line 1. Column 10, line 1** reads: "Next in the step of FIG. 9D...", suggesting that rotating the magnetization direction is performed in a number of

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successive steps (i.e. FIG. 9B: step 1, FIG. 9C: step 2, and so forth), and not in a single step as argued by applicant.

In response to applicant's argument that Nakao fails to teach that the rotation of the magnetization direction results from only the magnetic fields resulting from application of the word line current and the bit line current, the Examiner directs applicant's attention to **column 6, lines 34-39 and column 9, lines 56-63**. Although Nakao does teach application of an external magnetic field (H_{offset}), this field is not directly used to rotate the magnetic direction of the soft magnetic layer, but instead is used to reduce the magnitude of write currents I_{wx} and I_{wy} . As disclosed at **column 9, lines 56-63**, only the magnetic field induced by application of word line write current I_{wx} and bit line write current I_{wy} is used in each step represented by **FIG. 9B-9E** to rotate the magnetization direction of the soft magnetic layer.

Claim Rejections - 35 USC § 102

4. The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

A person shall be entitled to a patent unless –

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

5. Claims 1 and 4 are rejected under 35 U.S.C. 102(e) as being anticipated by Nakao.

Pertaining to claim 1, **FIG. 3A and FIG. 9A-9B** are directed towards: A method for writing to magnetoresistive memory cells of an MRAM memory, the magnetoresistive memory cells having a multilayer system containing layers **1-3** stacked one above another, the layers including a soft-magnetic layer **2**, a hard-magnetic layer **1** and a tunnel oxide layer **3** disposed between the soft- magnetic layer and the hard-magnetic layer, which comprises the steps of: impressing write currents **I_{Wx} , I_{Wy}** being in each case impressed on a respective word line **4** and a respective bit line **5** resulting in a superposition of magnetic fields generated by the write currents, and in each selected memory cell selected by the respective word line and the respective bit line, a magnetic field **H_x , H_y** leads to a change of a magnetization direction of only the soft-magnetic layer **Note: It is inherent for free layer 2 of FIG. 3A to be the only layer capable of having a variable magnetization direction (see column 5, lines 6-11)**, the write currents being impressed on the respective word line and the respective bit line causing a magnetic field produced by the superposition of only a magnetic field of the respective word line current and a magnetic field of the respective bit line current **(see explanation above in item 3)** to be precisely large enough to suffice for switching the magnetization of the soft magnetic layer in the selected memory cell but small enough that neither adjacent cells nor non-selected memory cells situated on the selected lines are switched **see column 10, lines 32-52; Note: It is inherent that the term “adjacent” disclosed in column 10, lines 32-52 also refers to cells on the same selected line**, the timings of the impression of both the respective word line current and the respective bit line current being exactly controlled so that the conventional switching of the soft

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magnetic layer of the selected memory cell is transferred into a magnetization rotation process rotating said magnetization direction of the soft magnetic layer in a plurality of successive steps in direction desired for writing a logic "0" or "1" **Note: Application of word line current I_{wx} and bit line current I_{wy} are done in a specified time period of 1ns so that the magnetization direction is switched according to FIG. 9B-9E (see column 9, line 46 – column 10, line 12. Additionally, it is inherent to write either a logic "0" or logic "1" to a memory cell.**

Pertaining to claim 4, **FIG. 3A and 5A** of Nakao are directed towards: an array **30** containing magnetoresistive memory cells **27** each having a multilayer system with layers **1-3** stacked one above another, said layers including a soft-magnetic layer **2**, a hard- magnetic layer **1**, and a tunnel oxide layer **3** disposed between said soft-magnetic layer and said hard-magnetic layer; word lines **4**; bits lines **5** crossing said word lines at each of said magnetoresistive memory cells; a writing control circuit for impressing write currents in each case onto a respective word line and a respective bit line of a respective memory cell selected for writing, said writing control circuit having a write circuit for impressing the write currents in each case on said respective word line and said respective bit line causing a magnetic field produced by the superposition of only a magnetic field of the respective word line current and a magnetic field of the respective bit line current **(see explanation above in item 3)** to be precisely large enough to suffice for switching the magnetization of the soft magnetic layer in the selected memory cell but small enough that neither adjacent cells nor non-selected cells situated on the selected lines are switched **see column 10, lines 32-52; Note: It is inherent that the**

term “adjacent” disclosed in column 10, lines 32-52 also refers to cells on the same selected line, said write circuit controlling the timings of the impression of both said respective word line current and said respective bit line current exactly causing the conventional switching of the soft magnetic layer of the selected memory cell to be transferred into a magnetization rotation with only the soft magnetic layer of the respective memory cell being rotated in a plurality of successive steps in a direction desired for writing a logic “0” or “1”. **Note: Application of word line current I_{wx} and bit line current I_{wy} are done in a specified time period of 1ns so that the magnetization direction is switched according to FIG. 9B-9E (see column 9, line 46 – column 10, line 12). Additionally, it is inherent to write either a logic “0” or logic “1” to a memory cell.**

Allowable Subject Matter

6. Claims 2 and 5-7 are objected to as being dependent upon a rejected base claim, but would be allowable if rewritten in independent form including all of the limitations of the base claim and any intervening claims. The following is a statement of reasons for the indication of allowable subject matter: the prior art of record considered pertinent to the applicant's disclosure, whether taken individually or in combination, does not teach or suggest: impressing the write currents for the selected memory cell in each case in approximately a same duration and in a manner offset in time with respect to one another by half of their switching duration (**see claim 2**), impressing a write bit line current in the same direction as a write word line current, and in a delayed manner

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when writing a logic "1" (**see claim 5**), the steps of rotating a magnetization direction as outlined in **claim 7, lines 1-19**.

Conclusion


Any inquiry concerning this communication or earlier communications from the examiner should be directed to Kretelia Graham whose telephone number is (571) 272-5055. The examiner can normally be reached on Mon-Fri 8am-4:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Amir Zarabian can be reached on (571) 272-1852. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free). If you would like assistance from a USPTO Customer Service Representative or access to the automated information system, call 800-786-9199 (IN USA OR CANADA) or 571-272-1000.

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